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Bacteriophage depolymerases– novel polysaccharide degrading enzymes

Hugo Oliveira, Diana Pires, Luís Melo, Leon Kluskens, Sanna Sillankorva, Joana Azeredo

CEB - Centre of Biological Engineering, LIBRO - Laboratory of Research in Biofilms Rosário Oliveira, University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal;
hugooliveira@deb.uminho.pt

In nature, biofilms are the most common lifestyle of bacteria and are difficult to eradicate, partially due to the extracellular polymeric substances content of the slime in which biofilms are embedded, which act as a primary defence against disinfection.(Bacterio)phages are viruses that specifically infect bacteria and can represent an important strategy for biofilm control. These viruses have evolved specialized enzymes, called depolymerises, to degrade polymers present in the bacterial surface and slime (e.g. capsular and structural polysaccharides) to facilitate access to their hosts. We performed an *in silico* analysis of all available phage genomes infecting different bacteria and found 160 putative depolymerises with specialized activity (e.g. hyaluronidases, alginate and pectate lyases). This illustrates how well phages are equipped to degrade a diverse range of biofilm-associated polymers. We cloned and recombinantly expressed an *Acinetobacter* phage depolymerise and demonstrated its activity by the spot-on-lawn method. To further characterize the enzyme activity, the bacterial host genome was sequenced and a cluster (24.6 kb) of genes responsible for the capsular polysaccharide biosynthesis was identified. Using DNA recombination, mutations in either of the two transcribing strands were introduced to generate capsular polysaccharides deficient mutants. Results demonstrate that the depolymerise specifically degrades *Acinetobacter* capsular polysaccharides. Overall, *in silico* and experimental results suggest that phage represent a source of enzymes to degrade polymeric substances presence in bacterial slime, which can be further exploited for biofilm control.